

Claims

1. A polar loop transmitter, comprising:
an envelope loop;
5 a phase loop; and
components disposed within each of the phase and envelope loops
configured to match the transfer characteristics of the phase and envelope loops.
2. A polar loop transmitter according to claim 1, wherein said matching
10 components comprise a loop filter in each of the phase and envelope loops.
3. A polar loop transmitter according to claim 2, operable over an operating
frequency range, wherein each loop filter is configured so that the transfer
characteristics of the phase and envelope loops are matched over the operating
15 frequency range.
4. A polar loop transmitter according to claim 2, wherein each loop filter is
configured so that the phase and envelope loops are of the same type and have
substantially the same bandwidth and loop damping.
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5. A polar loop transmitter according to claim 1, including a power amplifier
for providing an output signal, wherein the envelope loop includes an envelope
control system for the output signal.
- 25 6. A polar loop transmitter according to claim 5, wherein the envelope control
system includes a power supply modulator arranged to modulate the voltage supply
of the power amplifier.
7. A polar loop transmitter according to claim 5, wherein the envelope loop
30 includes an envelope detector.

8. A polar loop transmitter according to claim 7, wherein the envelope detector is connected to a bias control input of the power amplifier, whereby to provide the envelope control system.

5 9. A polar loop transmitter according to claim 5, further comprising compensation means disposed in the envelope loop for compensating for non-linearities in the envelope control system.

10 10. A polar loop transmitter according to claim 5, comprising first and second envelope detectors for detecting input and output envelopes respectively and a system for providing a difference signal representative of the difference between the input and output envelopes.

15 11. A polar transmitter according to claim 10, wherein said difference signal providing system comprises a comparator.

12. A polar loop transmitter according to claim 10, further comprising a detector configured to detect loss of feedback control.

20 13. A polar loop transmitter according to claim 12, wherein the detector is operative on the difference signal.

14. A polar loop transmitter comprising:

25 a power amplifier for amplifying an input signal having input phase and envelope components to produce an output signal having output phase and envelope components;

an envelope loop including elements configured to produce an envelope difference signal representative of the difference between the input and output envelope components, said envelope loop having a loop transfer characteristic;

30 a phase loop including elements configured to produce a phase difference signal representative of the difference between the input and output phase components, said phase loop having a loop transfer characteristic; and

elements disposed within each of the phase and envelope loops configured to match the transfer characteristics of the phase and envelope loops.

15. A portable communications device including a polar loop transmitter,
5 comprising:

an envelope loop;

a phase loop; and

components disposed within each of the phase and envelope loops configured to match the transfer characteristics of the phase and envelope loops.

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16. A portable communications device including a polar loop transmitter comprising:

a power amplifier for amplifying an input signal having input phase and envelope components to produce an output signal having output phase and
15 envelope components;

an envelope loop including elements configured to produce an envelope difference signal representative of the difference between the input and output envelope components, said envelope loop having a loop transfer characteristic;

a phase loop including elements configured to produce a phase difference
20 signal representative of the difference between the input and output phase components, said phase loop having a loop transfer characteristic; and

elements disposed within each of the phase and envelope loops configured to match the transfer characteristics of the phase and envelope loops.

- 25 17. An envelope elimination and restoration transmitter including a power amplifier having a bias control input, wherein the transmitter includes an envelope detector for detecting the envelope of an input signal and the output of the envelope detector is connected to the bias control input of the amplifier to control the output signal envelope.

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18. An envelope elimination and restoration transmitter according to claim 17, further comprising a slow power supply modulator configured to modulate the supply voltage to the power amplifier.

19. An envelope elimination and restoration transmitter according to claim 17, configured so as to linearise the transmitter.

5 20. An envelope elimination and restoration transmitter according to claim 19, wherein the linearising configuration includes an envelope feedback loop.

21. An envelope elimination and restoration transmitter according to claim 20, further comprising a phase feedback loop.

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22. An envelope elimination and restoration transmitter according to claim 19, including a signal generator for generating pre-distorted signals whereby to provide a linearising configuration.

15 23. A portable communications device including an envelope elimination and restoration transmitter including a power amplifier having a bias control input, wherein the transmitter includes an envelope detector for detecting the envelope of an input signal and the output of the envelope detector is connected to the bias control input of the amplifier to control the output signal envelope.

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24. An envelope feedback transmitter including a power amplifier providing an output signal;

a controller for controlling the envelope of the output signal; and

a compensator for compensating for non-linear characteristics of the

25 envelope controller.

25. An envelope feedback transmitter according to claim 24, wherein the power amplifier has a voltage supply and the envelope controller comprises a modulator for modulating the voltage supply.

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26. An envelope feedback transmitter according to claim 24, wherein the power amplifier has a bias control input, the feedback transmitter further comprising a difference signal generator means for providing a difference signal representative of

the difference between input and output envelope components, wherein the difference signal is connected to the bias control input of the power amplifier to provide the envelope control means.

5 27. An envelope feedback transmitter according to claim 26, wherein the difference signal is connected to the bias control input of the power amplifier via a loop filter.

10 28. An envelope feedback transmitter according to claim 26, wherein the difference signal generator comprises a comparator arranged to receive signals from first and second envelope detectors for detecting the input and output envelope components respectively.

15 29. An envelope feedback transmitter according to claim 28, wherein the compensator is disposed between the output of the amplifier and the input to the comparator.

20 30. An envelope feedback transmitter according to claim 29, wherein the compensator comprises first and second compensation elements, the first compensation element being disposed between the first envelope detector and a first input to the comparator and the second compensation element being disposed between the second envelope detector and a second input to the comparator.

25 31. An envelope feedback transmitter according to claim 30, wherein the first and second compensation elements have a large signal transfer function which approximates to the inverse of the large signal transfer function of the envelope control means.

30 32. An envelope feedback transmitter according to claim 28, wherein the compensator is disposed between the output of the comparator and the envelope controller.

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33. An envelope feedback transmitter according to claim 32, wherein the compensation element has a linear transfer function with variable gain and a non-linear gain control.

5 34. An envelope feedback transmitter according to claim 33, wherein the non-linear gain control is connected to either one of the first and second envelope detectors.

10 35. An envelope feedback transmitter according to claim 24, further comprising a phase feedback loop.

15 36. A portable communications device including an envelope feedback transmitter including a power amplifier providing an output signal;
a controller for controlling the envelope of the output signal; and
a compensator for compensating for non-linear characteristics of the envelope controller.

20 37. A feedback transmitter having an arrangement for providing a difference signal representative of the difference between input and feedback signals, comprising a detector configured to detect a loss of feedback control when the difference signal exceeds a predetermined threshold.

25 38. A feedback transmitter according to claim 37 comprising an envelope elimination and restoration transmitter, in which the detector comprises an amplitude detector configured to detect a loss of feedback control when the amplitude of the envelope error exceeds a predetermined threshold.

30 39. A feedback transmitter according to claim 38, further comprising:
a power amplifier for amplifying an input signal having input phase and envelope components to produce an output signal having output phase and envelope components;
an envelope loop including elements configured to produce an envelope difference signal representative of the difference between the input and output

envelope components, wherein the amplitude detector is configured to monitor the difference signal.

40. A feedback transmitter according to claim 38, further comprising a
5 comparator for producing the difference signal, the comparator being configured to receive output signals from first and second envelope detectors.

41. A feedback transmitter according to claim 37, comprising a Cartesian
10 transmitter in which the difference signal is representative of the difference between in-phase I input and feedback signals or quaternary Q input and feedback signals.

42. A portable communications device including a feedback transmitter having
an arrangement for providing a difference signal representative of the difference
15 between input and feedback signals, comprising a detector configured to detect a loss of feedback control when the difference signal exceeds a predetermined threshold.

43. A method of detecting a loss of loop control in a feedback transmitter
providing a difference signal representative of the difference between input and
20 output signal components, comprising monitoring the difference signal and detecting a difference signal deviation greater than a predefined threshold.

44. A method according to claim 43, wherein the input and output signal
components comprise signal envelope components.

45. A method according to claim 44, wherein the step of detecting a difference
signal deviation comprises detecting a difference signal amplitude greater than a
predefined threshold.

46. A method according to claim 44, further including averaging the difference
30 signal.